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JOURNAL
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ELISHA MITCHELL SCIENTIFIC SOCIETY

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THE REDUCTION OF NAPHTAZARINE

BY ALVIN S. WHEELER AND CHAS. S. VENABLE

The reduction of naphtazarine was first carried out by Zincke and Schmidt (Ann., 286,27 (1910)). The more descriptive name of this compound is, 1, 2-dihydroxy-5, 8-naphthoquinone, formerly called 5, 6-dihydroxy-1,4-napthoquinone. The authors mentioned employed stannous chloride and hydrochloric acid, stating that the reaction did not go to completion if zinc dust was used. The reddish brown quinone is converted into the dull yellow tetrahydroxynaphthalene, designated by them as 1,4,5, 6-tetraoxynaphthalene, now more properly described as the 1, 2, 5, 8-tetrahydroxynapthalene. This compound is a peculiarly interesting one on account of the ready change which it undergoes in solutions. In the solid state it consists of yellow needles which turn red as they melt at 154°. All solutions in organic solvents turn red on standing, and a product more or less red is recovered therefrom. When pure this substance also melts at 154°. According to Zincke and Schmidt it has the same composition as the yellow reduction product. In view of the ready oxidation of the yellow tetrahydroxnaphthalene to the reddish brown naptazarine, the authors came to the conclusion that the red product melting at 154° was in reality the yellow compound mixed with a small amount of oxidation products. They obtained the same acetyl derivative from the yellow and the red compounds. We are unable to concur in this view, knowing what a marked effect in lowering the melting point only slight quantities of impurities have. We propose another explanation which lies in the theory that we have here a case of desmotropy in which a labile hydrogen is causing a keto-enol isomerism.

$$\text{(A)}\quad \begin{matrix} -C-OH \\ \| \\ -C-H \end{matrix} \rightleftarrows \begin{matrix} -C=O \\ | \\ -C=H_2 \end{matrix}\quad \text{(B)}$$

A represents the enol form and B the keto form. The first type is a phenol or if in the aliphatic series an alcohol while the second type is a ketone. New cases of this sort have been coming to light in recent years. It is clearing up some doubtful questions of constitution. For instance Meyer (Ann., 379,37 (1910)) has lately shown that anthranol is in reality anthrone, the keto-form. As a rule when these isomeric forms are separate and in the dry state they are stable but in solution they are unstable and pass readily into each other. The reaction is reversible and incomplete. The direction of the reaction depends upon the temperature and the nature of the catalysor. Since both forms exist in the same solution, the solution will respond to the reaction of the hydroxyl group and of the carbonyl group. The relative amounts of the two forms in solution is difficult to determine, since the equilibrium is very readily disturbed. A number of methods have been employed. Meyer (Ann., 379,37 (1910), 396,141 (1912)) has proposed a titration method with bromine at a low temperature. The enol-form, e. g., anthranol, gives a strong blue fluorescent solution whereas the solution of anthrone is non-fluorescent. Since bromine acts quickly upon the enol-form and not upon the keto-form, the end point or disappearance of the fluorescence is readily seen if the solution is illuminated by ultraviolet light given by iron electrodes. This method we were unable to use in our case though we made a number of attempts to do so. We found that the action of bromine upon the tetrahydroxynaphthalene was not smooth and sufficiently well defined.

An alkaline solution of the yellow compound shows a strong greenish fluorescence, indicating the presence of at least some of the enol-form. The reaction with acetic anhydride, which yields a tetracetyl derivative, also points to the enol-form but Zincke and Schmidt give no indication of the yield obtained. Reactions in strongly alkaline solutions applicable to the carbonyl group can not be made owing to the ready oxidation to naphtazarine. For this reason we are employing phenylsemi-

carbazine which is weakly basic and propose to follow with semicarbazine which is not so weak a base. Conclusive statements can not yet be made as to the constitution of the yellow and red forms but the question is being actively studied in our laboratory.

EXPERIMENTAL PART

Purification of Naphtazarine

We were presented with one-half kilogram of naphtazarine by the Badische Anilin u. Soda Fabrik in Ludwigshafen am Rhein and wish to express here our sincere thanks for the same. In order to bring the material to a higher state of purity we tried to recrystallize it from various solvents but could find no suitable solvent. So we resorted to the sublimation process, employing a large sublimation apparatus similar to one described by Morey (Journ. Amer. Chem. Soc., 34,550 (1912)). The copper or platinum vessel containing the substance rested upon a resistance coil of nichrome wire carrying 1.5 amperes of current. This was placed upon a very tall inverted beaker which stood in a large flat crystallizing dish. Over the whole was inverted a bell jar and a still larger one over this. The whole rested upon a metallic plate, the bottom of an old vacuum pump with a hole in the center. This hole gave insertion to the tube leading to the May-Nelson electric vacuum pump. A vacuum of 2 to 10 mm. was maintained 5 to 8 hours for each 15 gram lot. One-third of the material was non-sublimable. The sublimed product consists of glistening green needles which upon being powdered formed a dark red mass. Naphtazarine possesses no melting point but sublimes above 140°.

Reduction of Naphtazarine

The naphtazarine was reduced by suspending 20 grams in 95 per cent. alcohol, adding 100 grams stannous chloride dissolved in 50 cc. concentrated hydrochloric acid and boiling the mixture on the water bath under a reflux condenser for thirty minutes. This produced a clear greenish red solution containing only a few insoluble particles. An odor of hydrogen sulfide was quite pronounced. In order to isolate the product it is very unsatisfactory merely to pour the solution into water or

dilute hydrochloric acid and filter. After many experiments we proceeeded as follows. The alcoholic solution is poured into 5000 cc. 12 per cent. hydrochloric acid and heated to boiling till practically all of the precipitated product has redissolved. Small insoluble impurities were filtered off on a Buchner funnel with suction while the solution was hot. On allowing the filtrate to stand over night, a mass of yellow needles had separated. These were filtered off, washed with water and dried. The yield was 9 grams. The product melted at 153°. The crystals are a dull yellow but powder to a bright yellow mass. The compound is easily soluble in alcohol and chloroform, fairly soluble in carbon tetrachloride and only slightly soluble in gasolene. The solutions turn red on standing even when air is displaced by nitrogen. Solutions in alkalies are blue with a brilliant fluorescence. The sodium or potassium salt which separates out however is that of naphtazarine. This oxidation we found will take place even at 0° and in an atmosphere of carbon dioxide. The tetrahydroxynaphthalene is therefore very sensitive to alkalies.

Preparation of Phenylsemicarbazine

Phenylsemicarbazine was prepared by first making phenylurea from aniline by the action of potassium cyanate and then treating this with hydrazine hydrate. In order to make the phenylurea the method of W. Weith (Ber., 9,820) was followed. One molecule (25g) aniline was mixed slowly with one molecule (25cc. sp. gr. 1.17) hydrochloric acid. The mass was cooled and one molecule (21.8g) of potassium cyanate was added slowly. The nearly solid mass was filtered, washed and dried on a porous plate. Yield, 26g. The melting point was 147°. The formula of phenylurea is $NH_2.CO.NHC_6H_5$. To convert the phenylurea into phenylsemicarbazine the method of Curtius and Burkhardt (Journ. f. prakt. Chem., (2) 58,220) was followed. Ten grams of phenylurea were placed in a small round bottom flask with 5g absolute alcohol and 8g hydrazine hydrate. The flask was attached to a reflux condenser with a ground glass joint and the mixture was boiled fifteen hours. On cooling the mass solidified. This was rinsed out into a porcelain

dish with water and heated upon a water bath until the odor of ammonia could no longer be detected. The product was impure and remained so after extraction with ether. It was therefore converted into its hydrochloride by adding 5 parts of alcohol and 5 parts of concentrated hydrochloric acid. The resulting emulsion was filtered with suction and washed with very little water. The residue was dissolved in 5 parts of water, filtered from slight impurities and finally neutralized with pure sodium hydroxide. The resulting solution was allowed to crystallize slowly. The product obtained thus was pure, melting at 122°. This is a very efficient addition to the purification process of Curtius and Burkhardt. The formula is $NH_2NH.CO.NHC_6H_5$. The melting point of the hydrochloride is 216°.

Action of Phenylsemicarbazine on Tetrahydroxynaphthalene

The action of phenylsemicarbazine on the yellow and the red forms of tetrahydroxynaphthalene was studied simultaneously. The amounts used were in the proportion of one molecule to one molecule. Saturated solutions of each were mixed and two series were carried out, one in alcohol solution, the other in chloroform solution. The solutions were kept in beakers placed in desiccators. In the alcoholic solutions precipitation began about the fourth day and gradually increased, a slow evaporation of the solvent taking place simultaneously. The precipitates were dark colored, the solutions being dark red. Recrystallized from alcohol the products became lighter brown and behaved similarly on heating in a capillary tube, darkening at 205° and decomposing at 214°.

In the chloroform series the yellow form made a yellow solution and the red form a red solution. On the third day the precipitation began in the yellow solution but none took place in the red solution until the seventh day. Precipitation continued in each case until the weight of the precipitate was equal to 55 per cent. of the total weight of the reacting substances. The crystals in both cases were light yellow in color and behaved upon heating like the products from the alcoholic solutions. The analytical work was interrupted before entirely satisfactory

figures were obtained for a pure phenylsemicarbazone, although a good figure was obtained for carbon. The hydrogen persisted in being 0.6 to 0.8 per cent too high. It is not surprising that phenylsemicarbazine should cause a reaction in solutions of both the yellow and the red forms since in solution both enol and keto-forms exist simultaneously. A further study of this question is under way.

Bromination of Tetrahydroxynaphthalene

According to Meyer enol forms react instantaneously with bromine whereas saturated keto-forms do not. The constitution of tetrahydroxynaphthalene complicates this reaction because the bromine may not only act upon the four hydroxyl groups present but also upon the four hydrogen atoms in the nuclei. We made four comparative experiments using 1, 2, 3 and 4 molecules of bromine respectively for one molecule of the tetrahydroxynahthalene. Saturated glacial acetic acid solutions of both substances were used and the reactions were started at 10°. No reaction was apparent at first in any case but on standing at room temperature over night masses of crystals appeared in every case. The results are briefly stated as follows: I. 0. 5g substance + 0.47g Br. Product, black crystalline mass, 0.46g. Sublimes at 260° without melting. II. 0.5g substance + 0.94g Br. Product, red crystals, 0.63g. Sublimes at 160-200°. III. 0.5g substance + 1.41g Br. Product, reddish orange crystals, 0.78g. Sublimes at 150-240°. Melts at 240-252°. IV. 0.5g substance + 1.88g Br. Product, yellowish orange crystals, 0.56g. Melt at 168-174° and decompose above 174° to a dark red liquid. The last product appears to be the purest but there is a decided falling off in the yield. The reaction will be studied further in this laboratory.

CHAPEL HILL, N. C.

CONVOCATION WEEK MEETINGS OF THE SCIENTIFIC SOCIETIES

THE AMERICAN ASSOCIATION

For the first time since the New Orleans meeting in 1906 the American Association for the Advancement of Science came south during the Christmas holidays for its regular winter meeting—from December 29, 1913, to January 3, 1914. Atlanta was the city chosen, and it lived up to its reputation by giving the scientists a cordial and hospitable welcome. The affiliated societies that followed the Association this year (somewhat fewer than usual, as was to be expected) were the following:

Astronomical and Astrophysical Society of America.
Botanical Society of America.
American Association of Economic Entomologists.
Entomological Society of America.
American Microscopical Society.
American Physical Society.
American Phytopathological Association.
School Garden Association of America.
Southern Society for Philosophy and Psychology.

The total number of scientists that took part in these meetings can only be estimated, as the members of the affiliated and other societies often neglect to register at the desk of the American Association. The number was probably over 500.

There were 428 papers on the program, distributed as follows:

Mathematics and Astronomy	30
Physics	20
Chemistry	16
Engineering	31
Geology	34
Zoology (including Entomology)	111
Botany (including Phytopathology)	108
Anthropology, Psychology, and Education	36
Economics and Social Science	29
Physiology and Experimental Medicine	13
	428

The address of the retiring president, Dr. E. C. Pickering, Director of the Harvard College Observatory, on *The Study of the Stars* was full of interest to every one. I take space to make the following quotation:[1]

> The first catalogue of the stars was made by Hipparchus about B. C. 128, and was inserted by Ptolemy in the "Almagest," for fourteen centuries the authority in Astronomy for the world. This catalogue which contained more than a thousand stars, gave both their position and brightness. The earliest copy that is known of the "Almagest" is in the Bibliotheque National in Paris. It is a beautiful manuscript in unical characters of the ninth century. The other later manuscripts unfortunately differ from it and from each other, so that there is some uncertainty regarding two thirds of the stars, owing to errors of copying. A careful study of these discrepancies has been made by Dr. Peters, of Clinton, and Mr. Knobel, of London. Each spent several years on this work, and all the papers are in the hands of Mr. Knobel. He is now preparing the whole for publication and it is hoped that it will be in the hands of the printer in a few months.
>
> A manuscript of nearly the same age is in the library of the Vatican and this year a revised edition of it has been published. If we had a correct copy of the original work, it would have a great value at the present time. Half a century ago it would probably have given the best existing values of the proper motions of the stars which it contained, but recent observations enable us to compute their position in the time of Hipparchus, more accurately than he could observe them, assuming that the motion was rectilinear. This work might, however, throw light on a possible curviture of the motions. The observations by Hipparchus of the light of the stars have a value that will be considered later. . . . .
>
> There are several kinds of variable stars. Variables of long period undergo changes which repeat themselves somewhat irregularly in a period of several months, and at a maximum are often several thousand times as bright as at minimum. . . . .
>
> Variables of short period complete their changes in a few days, or hours. Professor Bailey has found five hundred such objects in the globular clusters. In one of these clusters, Messier 3, out of a thousand stars one seventh are variable, all have a period of about half a day, and their periods are known within a fraction of a second. Their light changes so rapidly that in one case it doubles in seven minutes. It is a strange thought that out of a thousand stars, looking exactly alike, there should be a hundred little chronometers keeping perfect time, and whose rate is known with such accuracy.

Of the many interesting points brought out in the vice-presidential addresses before the sections we can here mention only a few. Professor J. McKeen Cattell, of Columbia University, spoke on *Science, Education, and Democracy.* The following paragraphs are worth attention:[2]

> The average salary paid to teachers in the public schools of North Carolina is $199, of Pennsylvania $440, of California $817. The state of

[1] Science N. S. 39: 2 and 7. Jan. 2, 1914.
[2] Science N. S. 39: 161 and 164. Jan. 1914.

Pennsylvania spends on its entire educational system less than one tenth of the value of the coal it mines. When a state consumes its natural resources it should reinvest their entire value in education, scientific research and the public welfare. In 1880 forty per cent. of the teachers in our public schools were men; now the percentage is under twenty; in New England and in New York it is under ten. In Germany four fifths of the teachers are men. . . . .

It is for the honor and ultimate welfare of Georgia that twenty-five per cent. of its population are children of school age, whereas only seventeen per cent. of the population of New England and New York—probably less than twelve per cent of their native population—are of this age. Since 1880 Georgia has increased per-capita payment for public school education sixfold; New York and New England have only doubled theirs. In the past twenty years New York and New England have not increased their expenditure enough to make up for the depreciation in the value of money. Georgia spends each year 6.3 mills on the assessed valuation of its real and personal property on public-school education, New York state 4.7 mills.[2] [[2]Real estate is under assessed in Georgia. In New York personal property is scandalously understated, owing to the tax. Personal property in Massachusetts is valued at more than two thirds of the real estate, and in New York at less than one twentieth.] The south is bent under the inherited burden of slavery and the Civil War. But if it maintains its birth rate and cares properly for its children and its health, the center of wealth and civilization will return southward. . . . .

The progress of the physical sciences in the nineteenth century will in the coming century be paralleled by advances in the psychological sciences. Science and education have given us democracy; it is the duty and privilege of democracy to repay its debt by forwarding science and education to an extent not hitherto known in the world's history.

Before the Botanical Section Dr. D. S. Johnson, of Johns Hopkins University, spoke on *The History of the Discovery of Sexuality in Plants.* He gave a concise and useful review of the development of this problem and of its baffling nature for over 2,000 years to "philosophers" who time and again vainly settled it to their own satisfaction by an appeal to the "nature" of things. Only when philosophy was laid aside and its place taken by direct and accurate observations on plants themselves was progress made. From Dr. Johnson's conclusion we quote the following:[3]

The sexuality which was first suspected, and first experimentally proven, in the seed plants, has now been demonstrated in all groups of plants save the bacteria and their allies. The primary feature of the process, the union of the two parental nuclei, is the same in all. The method of bringing together the two nuclei varies widely, this variation sometimes involving even the complete disappearance of externally recognizable sexual organs. During the evolution of plants old methods of accomplishing the approximation of the nuclei have been discarded, and new methods have arisen. In the latter case a fusion of nuclei of closer kinship has often been submitted for the primitive one of more distantly related nuclei.

[3] Science N. S. 39: 317. Feb. 27, 1914.

This seems evidently the case, for example in the apogamous ascomycetes, perhaps also in the basidiomycetes, and surely so in the cases of nuclear fusion in the prothalia and in the sporangia of apogamous ferns.

The persistent delusion widely current in regard to the scientific value of certain mystical realms of thought and feeling, together with a general misconception of their relation to other phenomena, gives a timely interest to the address of Professor Arthur Gordon Webster on *The Methods of the Physical Sciences, to What are They Applicable?* In discussing "thought transference" he says:[4]

How easy it is for the layman to say, "We know that electromagnetic waves are transmitted in the ether, which we cannot perceive by the senses, why should not waves be emitted by the brain, and be similarly transmitted through the ether?" Why indeed! We may answer him that even if we know nothing more of the ether than the speed of waves through it we know that extremely well, and that whether or not we know the mechanism of the waves (as I conceive that we do) we at least know their differential equations, that is, the mode of their transference. Moreover we have many instruments that are affected by these waves, whereas no one has ever managed, by means of thought waves, to affect the most sensitive instrument, whether torsion balance, quatzfiber, electrometer or galvonemeter. When by taking thought, a mind in this world or the next, shall produce the smallest deflection in an instrument at a distance, then we shall be within the means of a physical investigation. But says the enthusiast, perhaps these waves being not of physical but of mental origin, may be receivable not by physical, but only mental apparatus, and may work only directly on the resonators of the brain. Very well, let us begin with the phenomena that we can control. It is easy to emit brain waves, if such there be. The method described above is then applicable. But if we are in the region of seismic mental waves, there is nothing to do but have our mental resonators always in adjustment and attuned. Then will come the difficulty of discriminating between "strays" and real receptions. How great this difficulty is is shown by the almost vanishingly small results of the societies for physical research so called, and by the delusions from which reputable scientists have suffered. We may here mention the investigations on the celebrated Eusapia Paladino, who certainly secured good indorsements in Europe, but when brought here and examined by a committee including psychologists, physicists, and other detectives, was found to be explicable by purely physical hypotheses.

Among the most important matters of business transacted by the Association was the adoption of the following resolutions:

Resolved, That the council looks with favor upon the organization of a Brazilian division of the Association, and that a committee on organization be appointed for this work with Senator Eduardo Braga as chairman.

Resolved, That the Society of American Forestry be formally accepted as an affiliated society.

[4] Science N. S. 39: 50. Jan. 9, 1914.

Resolved, That the Council of the American Association for the Advancement of Science authorizes the establishment of local branches of the association in places where the members are prepared to conduct branches which will forward the objects of the association.

Resolved, That the standing committee on organization and membership be instructed to promote the establishment of such local branches.

The president elected for the coming year was Dr. Charles Wm. Eliot, president emeritus of Harvard University.

The next meeting will be held in Philadelphia during convocation week, 1914-1915.

W. C. COKER.

THE ZOOLOGISTS AND NATURALISTS

The American Society of Zoologists and the American Society of Naturalists met with various other biological societies in Philadelphia, December 29 to January 1. The Zoologists and Naturalists held their meeting in the new zoological laboratory of the University of Pennsylvania, a large and handsome building. It may be noted in passing how many universities have recently erected, or are about to erect, elaborate zoological laboratories costing from about $150,000 to $500,000. Princeton, Pennsylvania, Yale, in the East, and the state universities of Ohio, Missouri, and Minnesota, in the West, are in this class.

Important changes in the constitution of the Society of Zoologists, long considered, were fortunately carried through, resulting in the union of eastern and central (middle west) branches of the society. The opportunity still remains for the formation of local sections, wherever ten or more members of the general society can foregather.

The papers read before the Zoologists showed the usual diversity, falling under the heads of comparative anatomy, embryology, cytology, genetics, comparative physiology, ecology. Still other papers were grouped together as "miscellaneous." There were some exhibits, among which may be mentioned photographs of changes in color and pattern undergone by flounders (by Dr. S. O. Mast, of Johns Hopkins, reporting on an investigation carried out at the Beaufort Laboratory) and specimens of several generations of butterflies exhibiting Mendelian inheritance (by Dr. J. H. Gerould, of Dartmouth). Among the

papers which aroused most interest and discussion was one by Dr. Oscar Riddle, of the Carnegie Institution, dealing with the determination of sex through agencies apparently not connected with the chromosomes.

The meeting of the Naturalists included a morning and an afternoon session on December 31 and a dinner at night with the presidential address (by Prof. R. G. Harrison, of Yale). At the morning session several addresses, by invitation of the society, were given dealing with heredity and development. Among these Prof. F. R. Lillie's (University of Chicago) excited especial interest. Professor Lillie described experiments showing that the egg and sperm secrete substances intimately concerned in the process of fertilization. The afternoon was devoted to a discussion of teaching methods. It was brought out that a widespread desire exists to curtail the amount of time given to the study of structure (morphology) and to introduce more experimentation. This is a natural result of the progress of biological science during the past twenty years, and admirably illustrates the close connection between teaching and research, the latter, as it opens up new fields, influencing those conspectuses of phenomena which we call courses of instruction.

H. V. WILSON.

THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

For a number of years it has been the feeling of the members of the several scientific societies that are interested in closely related biological problems, that a closer cooperation of these societies was highly desirable.

At the Cleveland meeting in 1912 of the Physiological, Biochemical and Pharmacological societies, committees from these organizations were appointed to consider a plan for the affiliation of the different societies.

The committee consisted of three members from each organization. This committee submitted a plan of affiliation which was adopted at the meeting of the various societies in Philadelphia in December.

The plan as proposed by the committee consists in the formation of an organization composed of the American Physiological, the American Biochemical and American Society for Pharmacology and Experimental Theraupeutics. The organization of the affiliated societies is to be known as The Federation of American Societies for Experimental Biology.

At the December meeting the Federation was strengthened by admitting to membership the recently formed Society for Experimental Pathology.

As a result of this union an organization has been founded which has about 450 members.

It is hoped that the Naturalists, Zoologists, and Anatomists will meet with the Federation. Such was the case at the recent Philadelphia meeting.

It is not the object of the Federation that the several societies should in any way lose their identity, the different societies composing the Federation elect officers and conduct their meetings as usual. It is hoped, however, that by having joint meetings and that by the members of the different societies coming to know personally their co-workers that the efficiency of the various organizations will be increased and that the members of the different societies will find in the Federation a wide usefulness for the " promotion of research and the dissemination of truth."

The meeting in Philadelphia was notable for the number of members attending, the number and general excellence of the communications presented, and for the very enjoyable social gatherings in the form of the " dinners." In addition to these features the program committee very wisely allotted an afternoon session to be used for demonstrations.

The physiological and other demonstrations were given in the Pharmacological Laboratory of the University of Pennsylvania. The experiments were well planned, were unusually successful and constituted one of the most enjoyable and instructive features of the meeting.

The two demonstrations which likely aroused the most interest were conducted by Professor Abel and his associates and by Dr. Meltzer and Dr. Gates.

Professor Abel, Dr. Rountree and Dr. Turner demonstrated an apparatus for "Vividiffusion."

The apparatus consists in a large glass cylinder in which is a series of celloidin tubes. Surrounding the celloidin tubes different diffusion fluids may be used; salt solutions of different strength or glucose solutions. The celloidin tubes which are dialyzing tubes are attached at their ends to glass tubes. The latter are connected by rubber tubing with the animal used in the experiment.

An animal, preferably a dog, is anesthetized and glass canulas are placed in the caroted artery and jugular vein. The canula from the artery is connected with the intake tube of the diffusion apparatus and the canula in the vein is connected with the remaining glass tube which leads from the diffusion apparatus. By such a scheme blood passes from the animal through the arterial canula into the celloidin dialyzing tubes, through these tubes and back into the animal through the canula in the jugular vein.

In order to prevent the blood from clotting during the time it is in the celloidin tubes a solution of hirudin (leech extract) is injected into the arterial canula.

The use of such an apparatus opens a new field in the study of metabolism of the body in general, in the study of the metabolism of isolated organs, and in the removal from the body of a living animal of various toxic bodies. Used in the latter sense the apparatus will likely serve as a valuable therapeutic agent.

The demonstration by Dr. Meltzer and Dr. Gates consisted in showing the antagonism which exists between the salts of magnesium and calcium.

A rabbit was anesthetized by injecting a solution of magnesium salts. The anesthesia was profound. An injection of calcium salts was then made into the lateral ear vein of the animal. Within a very few seconds following the injection, consciousness had completely returned, the animal appearing in all respects normal.

The scientific communications presented at the meetings of

the various societies forming the Federation were of unusual interest and of very high grade.

The meetings came to a close on December 31st, 1913, at which time the first executive session of the Federation was held. At this meeting the feeling of the Federation concerning animal experimentation was expressed and adopted in the following form:

1. We, the members of the Federation of American Societies for Experimental Biology—comprising the American Physiological Society, the American Society of Biological Chemists, the American Society for Pharmacology and Experimental Therapeutics and the American Society for Experimental Pathology,—in convention assembled hereby express our accord with the declaration of the recent International Medical Congress, and other authoritative medical organizations, in favor of the scientific method designated properly animal experimentation but sometimes vivisection.
2. We point to the remarkable and numerable achievements by animal experimentation in the past in advancing the knowledge of biological laws and devising methods of procedure for the cure of disease and the prevention of suffering in human beings and lower animals. We emphasize the necessity of animal experimentation in continuing similar beneficient work in the future.
3. We are firmly opposed to cruelty to animals. We heartily support all humane efforts to prevent the wanton infliction of pain. The vast majority of experiments on animals need not be, and in fact, are not accompanied by any pain whatsoever. Under the regulations already in force, which reduce discomfort to the least possible amount and which require the decision of doubtful cases by the responsible laboratory director the performance of those rare experiments which involve pain, is we believe, justifiable.
4. We regret the widespread lack of information regarding the aims, achievements and procedures of animal experimentation. We deplore the persistent misrepresentation of these aims, achievements and procedure by those who are opposed to this scientific method. We protest against the frequent denunciations of self-sacrificing, high-minded men of science who are devoting their lives to the welfare of mankind in efforts to solve the complicated problems of living beings and their diseases.

WM. DEB. MACNIDER

THE BOTANICAL SOCIETY OF AMERICA

The Botanical Society of America met in Atlanta, in affiliation with the American Association for the Advancement of Science. About ninety members were present and a large program of fifty-five papers was offered. Among these we have space to mention only a few. Discussing the trend and influ-

ence of certain Phases of Taxonomy, Professor Aven Nelson said:[5]

> We are on the eve of a new era of reconstruction. Already the pendulum is swinging back toward greater conservatism. The dismemberment of genera and the multiplication of species proceed more cautiously. This grows out of the revitalized aim, "Make it easier for others to know plants."

The perplexity of the systematist may be understood when we consider the increasing evidence of numerous distinct strains within "species" whose characteristics are inherited and apparently well fixed. Such strains were reported by Mr. Chas. A. Shull in the cockle-burr, *Xanthium canadense,* and Professor A. F. Blakeslee showed that in cultures from a single spore of a species of *Mucor* variation occurred that retained their characters for some time. Of their variation he says "Many of them would undoubtedly be described as distinct species in the group."

Experiments by Mr. Jacob R. Schramer with seven species of green algæ gave no evidence of any power to fix free nitrogen.

Professor W. J. V. Osterhout reported as follows:[6]

> Van't Hoff's formulation of the laws of chemical dynamics has proved so stimulating to various fields of chemistry that it may be expected to be similarly useful if it can be applied to the activities of living protoplasm. The writer finds that by measuring the electrical resistance of living tissues it is possible to follow the progress of reaction in protoplasm in the same way that Van't Hoff followed the progress of reactions in vitro. It therefore becomes possible to apply Van't Hoff's methods and formulae directly to protoplasm in its living and active condition.

Professor Osterhout also finds that by means of electrical measurements of living tisues it is possible to predict which salts will antagonize each other when allowed to act upon these tissues.

Dr. R. H. True advocated the use of "normal physiological solution" for experimental purposes, rather than distilled water, which cannot, in practice, be obtained pure, and which moreover has been found to be injurious to certain plants, probably by absorbing from their roots some of the constituents necessary to the maintainance of life activities.

[5] Science N. S. 39: 255. Feb. 13, 1914.
[6] Science N. S. 39: 292. Feb. 20, 1914.

The most important matter of business that came before the Society was the report of the committee on the new botanical journal. This provides for a co-operative arrangement with the Brooklyn Botanic Garden which has made possible the immediate publication of the journal. This publication is known as the *American Journal of Botany* and it will be sent to all members of the Society. The first issue for January 1914 has already appeared. It will do a great deal to relieve the congestion of material that now exists in the sources of publication in this country.

Mr. A. S. Hitchcock, the well known agrostologist of the U. S. Department of Agriculture was elected president for the ensuing year.

W. C. COKER.

ABSTRACTS AND REVIEWS

THE TWENTY-SEVEN LINES UPON THE CUBIC SURFACE

The contributions which Dr. Henderson has, from time to time, made to the study of the cubic surface, were some time ago embodied in this able work.[1] The following review, though belated, purports to give a brief sketch of Dr. Henderson's work. The mere fact that it enjoys the distinction of being the second work by an American professor in this series of Cambridge University Memoirs bespeaks its quality. The other American professor to be thus honored was Dr. Maxine Böcher, of Harvard University.

In his Introduction, Dr. Henderson says: "In this memoir is given a general survey of the problem of the twenty-seven lines, from the geometric standpoint, with special attention to salient features: the concept of trihedral pairs, the configuration of the double six, the solution of the problem of constructing models of the double six configuration and of the configurations of the straight lines upon the twenty-one types of the cubic surface, the derivation of the Pascalian configuration from that of the lines upon the cubic surface with one conical point, and certain allied problems." Some of the principal results of the author's researches have been presented in papers read before the American Mathematical Society, the North Carolina Academy of Science, and the Elisha Mitchell Scientific Society. Furthermore, some conclusions have been incorporated by the author in the following papers, published within recent years: "On the Brianchon Configuration," *American Mathematical Monthly,* 36-41; "On the graphic representation of the projection of two triads of planes into the mystic hexagon," *Journal El. Mitch. Sci. Soc.,* 20:124-133, 1904; "A Memoir on the twenty-seven lines on the cubic surface," *Journ. El. Mitch. Sci. Soc.,* 21:76-87, 120-133, 105.

As Dr. A. C. Dixon has pointed out in the *Mathematical*

[1] The twenty-seven lines upon the cubic surface by Archibald Henderson. Published by the University of Cambridge, at the Cambridge University Press, London.

Gazette, the central problem attacked by Dr. Henderson is a fascinating one; and the author has solved the problem in a completely satisfactory and exhaustive way. The beautiful plates, thirteen in number, showing in perspective representation the lines on all twenty-one different types of the cubic surface, express the solution in concrete form. Noteworthy is the author's analytical investigation of the double-six theorem, which is both simple and self-contained.

It is to be noted that the author does not refer to Cremona's well-known form of the cubic, nor to the parametric representation of a variable point on the surface. To do so would doubtless have carried him too far afield, since this is not a treatise on the cubic surface, but the study of a particular configuration associated with it. The listing of the trihedral pairs seems to be carried out at needless length, until it is observed that they serve as the basis for subsequent conclusions. Especially noteworthy is chapter VII, dealing in an elegant manner, both analytically and geometrically with certain configurations associated with the configurations of the lines upon the cubic surface.

There is a long and valuable bibliography of the general literature in all languages in regard to the lines upon the cubic surface. It is all the more valuable in that it is, strangely enough, in view of the importance of the subject, the only one which has ever been compiled. The following title might profitably be added to this biblography: "Beziehungen der allgemeinen Fläche dritter Ordnung zu einer covarienten Fläche dritter Classe," by Th. Reye, *Math. Annalen,* Bd. Lv.; "Ueber einige Eigenschaften der allgemeinen Fläche dritter Ordnung," G. Kohn, *Wiener Sitzungsberichte,* Bd. cxvii; and Professor W. W. Burnside's recent paper in the *Cambridge Philosophical Proceedings* on double-sixes with projective transformations.

The two great English geometers, C. Salmon and A. Cayley, first studied the theory of straight lines upon a cubic surface in correspondence, subsequently published in 1849. In 1873, Cayley devised a method for constructing a double-six, but achieved only theoretical success in his effort to construct a model of the configuration. The significance of Dr. Hender-

son's work is that he has satisfactorily completed this work left unfinished by Cayley, and generalized it so as to apply to the complete configuration of all the lines upon each of the types of the cubic surface. This volume, as expressed in a recent review in *Nature,* is "carried through with great earnestness, and so far as possible with the simplest materials; its obvious sincerity cannot fail to be inspiring to anyone who will be at pains to understand it. The author's assembling of his materials for the constructions which follow, and the very want of useless elaboration is a proof of the independence with which the author has carried out his research."

WILLIAM CAIN.

DEVELOPMENT OF SPONGES FROM DISSOCIATED TISSUE CELLS

In this paper[2] the author, Dr. H. V. Wilson, presents in full detail the facts in his study of the restitution of sponges from dissociated cells. Precise information as to methods is also given. The larger part of the illustrations are photographs, chiefly at low magnification. The latter show the sponges as grown on slips of glass. As the writer mentions the sponges present many points of superficial similarity to myxomycete plasmodia. It is noteworthy that the method employed has proved to be one by which large numbers of sponges may be easily grown. Mr. R. R. Bridgers, at the time a student of this University, served as Professor Wilson's assistant and during one summer carried more than a hundred sponges to a stage where they were quite similar to normal sponges as one collects them in Beaufort harbor. A point of particular interest is that a number of Mr. Bridgers' sponges went so far as to produce embryos at the end of the season. From this standpoint the method seems promising for the study of the general question of embryo formation in sponges and quite possibly for the experimental determination of the conditions under which the sex elements are produced.

It is of interest to know that other investigators have shown that Professor Wilson's methods are applicable to fresh-water

[2] Bulletin of the Bureau of Fisheries, Volume XXX, 1910.

sponges and calcareous sponges. Karl Muller[1] has succeeded in growing Spongillas from dissociated cells. And Julian S. Huxley,[2] working at Naples, also succeeded in developing *Sycon raphanus* in the same way.

W. C. GEORGE.

ON THE BEHAVIOR OF THE DISSOCIATED CELLS IN HYDROIDS

In this paper[3] Dr. H. V. Wilson shows that hydroids may likewise be grown from dissociated cells. The methods practiced were essentially the same as those used for sponges. The hydroids, however, proved far more difficult objects to handle. Nevertheless, hydropolypes (Eudendrium, Pennaria) were developed with the characteristics of the species. Here again the methods may prove of use in studies of the origin of sex. In this paper Professor Wilson considers his observations more directly than in preceding papers from the standpoint of the reduction theory. He points out that in sponges this question is complicated by the presence in the sponges of large numbers of undifferentiated cells (amoebocytes). But in hydroids, such cells are present in a negligible quantity, and the restitution masses, therefore, undoubtedly are derived from the differentiated ectoderm and entoderm cells. These cells after dissociation lose their distinctive histological characteristics and combine to form a solid mass which again differentiates like a coelenterate embryo into ectoderm, entoderm, and a central yolk. These facts then certainly lend great weight to the idea that differentiated somatic cells may undergo a process of regressive differentiation (reduction), and pass into a generalized state physiologically similar to embryonic tissue.

W. C. GEORGE.

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[1] *Das Regenerationsvermögen der Suswasserschwämme, insbesondere Untersuchungen uber die bei ihnen vorkommende Regeneration nach Dissociation und Reunition.* Archiv F. Entwicklungsmechanik der Organismen, 32: 397-446. 1911.

[2] *Some Phenomena of Regeneration in Sycon; with a Note on the Structure of Its Collar-cells.* Philosophical Transactions of the Royal Society of London. Series B. 202: 165-189. 1911.

[3] The Journal of Experimental Zoology 11: 281-338. 1911.

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